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A LARGE OPHIACODONT PELYCOSAUR FROM THE PENNSYLVANIAN OF THE PITTSBURGH REGION

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The presence in the early Permian of a varied series of pelycosaurs indicates that the beginnings of this synapsid group occurred well back in Carboniferous times. Pennsylvanian remains of pelycosaurs are, however, very rare. Because of this paucity of data, the remains described below are worthy of record despite their incomplete and fragmentary nature.

Along the course of McKnight Road, about 6 miles north of Pittsburgh, Pennsylvania, there has recently been considerable quarrying of sand and shale deposits of Conemaugh age in order to level the surface for building construction. The materials quarried were used as fill in North Park, several miles farther north. During the course of this work geology students at the University of Pittsburgh noticed three pieces of bone in freshly dumped park fill; through the courtesy of Mr. Martin Bender of the University's geology department they were deposited in the Carnegie Museum. Inquiry made it rather certain that this material had been excavated from a locality on the east side of McKnight Road near the junction of Brown's Lane. The sandstone excavated here, lies just above the Ames limestone, and hence pertains to the upper part of the Conemaugh group of the Pennsylvanian. It seems certain that all three of the fragments, pertaining to a right shoulder girdle and front leg, were parts of a single, presumably articulated, specimen, but the state of the quarrying operation precluded any attempt to find further remains. The specimens are entered as no. 13942 in the vertebrate paleontology collections of the Carnegie Museum, Pittsburgh; I am indebted to Curator Craig Black for placing them in my hands for description. Needed preparation was done at the Museum of Comparative Zoology under a grant from the National Science Foundation.

The most revealing specimen consists of the distal half of a right humerus. It is clearly pelycosaurian in nature and, it would seem, equally certainly ophiacodontid, the diagnostic features being the greatly expanded entepicondyle, the transversely directed supinator process and the strong development of the lateral margin of the ectepicondyle. In addition, the preserved portion of the shaft indicates that proximal and distal halves of the bone were sharply twisted on one another as in ophiacodonts and in contrast to the lesser torsion in other pelycosaur groups. The overall breadth is 96 mm. The bone is almost exactly superposable on a mature *Ophiacodon* humerus in the M.C.Z. collections (no. 1426) from the Archer City bonebed (Putnam formation). This Texas element is 120 mm. in length, and pertains to a small individual of *O. retroversus* or to an immediate predecessor of that species. If the proportions of the present form were similar to those of *Ophiacodon*, the animal in life would have had a length of head and trunk combined of about 109 cm., and a total length (including the usual long pelycosaurian tail) of about 204 cm. or about 6′8″.

Our Pennsylvanian specimen thus appears to be one of the largest of ophiacodonts, exceeded in size only by *O. retroversus* and *O. major* of the later Wichita formations and by *Stercorhachis dominans* of the European Permian. Post-mortem, the bone has lost the hemispherical ventral swelling with which the radius articulated; the supinator process is imperfectly preserved and there has been some slight damage to the ventral surface at the end of the entepicondyle. Otherwise, apart from crushing, the bone is well preserved. Notable and possibly significant is the fact that ossification had been completed at the time of death. This is in contrast to most specimens of *Ophiacodon*, in which but a small fraction of limb bones show complete ossification of their ends, even when the animal appears to have reached a "mature" size.

Although the general pattern of the bone is comparable to that of *Ophiacodon*, there are definite differences in detail. The present specimen has, dorsally, a prominent muscle scar proximomedially situated near the end of the entepicondyle; this is not present in *Ophiacodon*. The ridge extending proximally along the lateral margin of the ectepicondyle is better developed in the present form than in *Ophiacodon*. The supinator process appears to be less developed than in that genus, but the apparent difference is due to post-mortem damage in our specimen.

A second fragment preserved is the proximal end of the right ulna. This has been greatly crushed, so that the sigmoid articular surface for the humerus is unnaturally narrow, and identification of diagnostic features is difficult. As in the case of the humerus, ossification is practically complete so that, in contrast to most *Ophiacodon* specimens, the whole olecranon is represented by bone rather than cartilage.

A third fragment is the upper end of a right scapula. The posterior margin is thickened and rounded in typical pelycosaur fashion. The lower posterior portion of the piece preserved is somewhat crushed and distorted, but there is an increase in thickness and a curvature of this border such as one would expect as the supraglenoid region is approached. In many pelycosaur specimens, even when seemingly "mature," the upper end of the scapular blade has a thickened distal edge obviously continued in cartilage. The present specimen, which appears to be nearly intact in the posterior part of its upper end, shows no such terminal surface; ossification was apparently complete. More anteriorly the bone has been damaged so that for about 6 cm. there is a thick broken margin on the preserved portion. Beyond and below this the margin as preserved, although imperfect, is thinner where broken off. Probably the missing area here had about the extent indicated by the broken line in the figure. The anterior margin flares out laterally to a marked degree from the general plane of the scapular blade. It seems fairly certain that there was considerable constriction in the width of the blade toward the bottom of the preserved segment. This is in contrast with *Ophiacodon* and *Varanosaurus* in which the scapular blade is broad throughout its height (the scapula of *Clepsydrops* is incompletely preserved).

Fragmentary as are the remains here described, they show definitely the presence at this horizon, fairly well down in the Upper Carboniferous, of a large pelycosaur which is surely an ophiacodontoid and nearly equally surely an ophiacodontid, antecedent although probably not ancestral to *Ophiacodon* of the Permian. Despite its incomplete nature, this fossil deserves taxonomic standing because of its importance in the story of pelycosaur evolution, and it is herewith made the holotype of *Clepysdrops? magnus*, sp. nov. It will not probably prove, when better known, to be generically distinct from *Clepsydrops*, but it appears to be related to that genus, likewise of late Carboniferous age, and it may be provisionally included in it. Because of imperfect knowledge of comparable anatomical features, we may

for the present rely for diagnosis simply on the size, which is approximately half again that of specimens assigned to the genotype, *C. collettii*.

Advantage may be taken of the present opportunity to mention a few fragmentary remains of Pennsylvanian pelycosaurs found in Ohio by Dr. Donald Baird and Mrs. Baird during a 1955 expedition of the Museum of Comparative Zoology. (1) M.C.Z. no. 2411 is from the Summerfield limestone of the Conemaugh group; the locality lies in Center Township, Noble County, Ohio, on the south side of state highway 78, just west of its junction with route 147. Found here were a crushed claw-shaped ungual phalanx 24 mm. long, comparable to the unguals of *Clepsydrops*, two complete pelycosaur centra with transverse diameters of 20 and 14 mm., and a fragmentary centrum with an estimated diameter of about 15 mm. (2) M.C.Z. no. 2295 from the Ewing limestone of the Conemaugh, in the central part of section 7, Noble Township, Noble County, a fragment of a centrum with an estimated diameter of 20 mm. or so. (3) M.C.Z. no. 2777, from the Lower Uniontown limestone of the Monongahela group, along Leith Run Road 3.8 miles from the junction with state route 7, Washington County, Ohio, an ungual phalanx comparable to that mentioned under no. 2411. It may be noted that this is the only identified reptilian bone from the Monongahela. There is, of course, little in these fragments to allow us to give any positive generic determination. But since these specimens are within the size range of the Illinois materials of *Clepsydrops* they may be provisionally referred to that genus.

As mentioned earlier, described pelycosaurian remains from the Carboniferous are very rare indeed. Their rarity is presumably to be correlated with the fact that most Carboniferous fossil localities are from coal swamps in which, apart from amphibious ophiacodonts, pelycosaurs would not be expected. Previously described are: (1) Numerous isolated elements of a small ophiacodontid, *Clepsydrops* (Romer and Price, 1940, pp. 212-216) from the McLeansboro formation near Danville, Illinois. (2) A fragmentary spine of a small *Edaphosaurus* from the Round Knob formation of the Conemaugh group near Pitcairn, Pennsylvania (Case, 1908, pp. 237-238; Romer and Price, 1940, p. 388). (3) From the late Stephanian of Kounova, Bohemia, a single vertebra of a similarly small *Edaphosaurus* (Romer and Price, 1940, p. 388). (4) From the same locality, a number of bones which represent a sphenacodont of good size, to which the name *Macromerion schwarzenbergii* is applicable (Romer, 1945, pp. 429-431).

Little as we know of Pennsylvanian pelycosaurs, a few general conclusions can be reached. That our scanty data on Carboniferous pelycosaurs should include remains of ophiacodonts such as *Clepsydrops* is not surprising. It is believed that the ophiacodontoids are the most primitive of pelycosaur stocks and would hence be expected to appear at an early period in the record. Further, it is believed that many, at least, of the ophiacodontids were amphibious in habit — essentially piscivorous water-dwellers whose ancestors had never abandoned an aquatic existence. In consequence the chances of finding ophiacodonts in the coal swamp deposits which constitute most of the Carboniferous record is much greater than of finding representatives of the more terrestrial sphenacodontoids or edaphosauroids.

Any idea that the finding of *Clepsydrops* in the Conemaugh takes us near in time to the point of origin of the pelycosaurs is an illusion. For fragments of edaphosaur spine have been recovered not only from the very late Kounova deposit but also from the Round Knob formation of the Conemaugh. *Edaphosaurus* is a highly specialized end form. It is obvious that its evolution from an ancestral pelycosaur must have begun at a time much further back in the Carboniferous than the Conemaugh. The assumption (not an unreasonable one) that the major pelycosaur groups evolved independently from a captorhinomorph stock only begs the question.

In general, reptilian stocks of any sort begin with forms that are of small size (as well as of primitive nature) and become increasingly larger as their history progresses. Such a process seems clear in the Lower Permian history of the pelycosaurs. The earliest dimetrodonts of the Texas Wichita were relatively small, and giants developed in the Clear Fork; *Edaphosaurus* species increase greatly in size in later beds; the caseids grew from small forms to enormous *Cotylorhynchus* species; even *Ophiacodon* (which became extinct before the typical Clear Fork) developed from small forms in the lower Wichita and New Mexican beds to the relatively gigantic *O. major,* in the Clyde Formation.

Until the discovery of the present specimen of *C. magnus* the known Pennsylvanian pelycosaur material fell in line with the belief that all early pelycosaurs were small. The *Clepsydrops* specimens from Illinois and Ohio represent small animals, as do both Pennsylvanian scraps of *Edaphosaurus.* To be sure, *Macromerion* of Kounova is a good-sized sphenacodont, but Kounova is close to the Permian boundary and *Macromerion* could be regarded as a slightly premature representative of the Permian

trend to large size. The discovery of *C. magnus*, however, destroys the illusion, for, as noted, this animal was larger than most of his later Permian relatives.

When and if we ever come upon Upper Carboniferous deposits with a representative terrestrial, rather than coal-swamp fauna, it can be confidently predicted that there will be included a considerable number of pelycosaurs which will vary widely in structure and size. It seems certain that for the origin of this fauna, of which so far we have but slight traces, we must look far back in the Carboniferous, to at least early Pottsville or Namurian levels.

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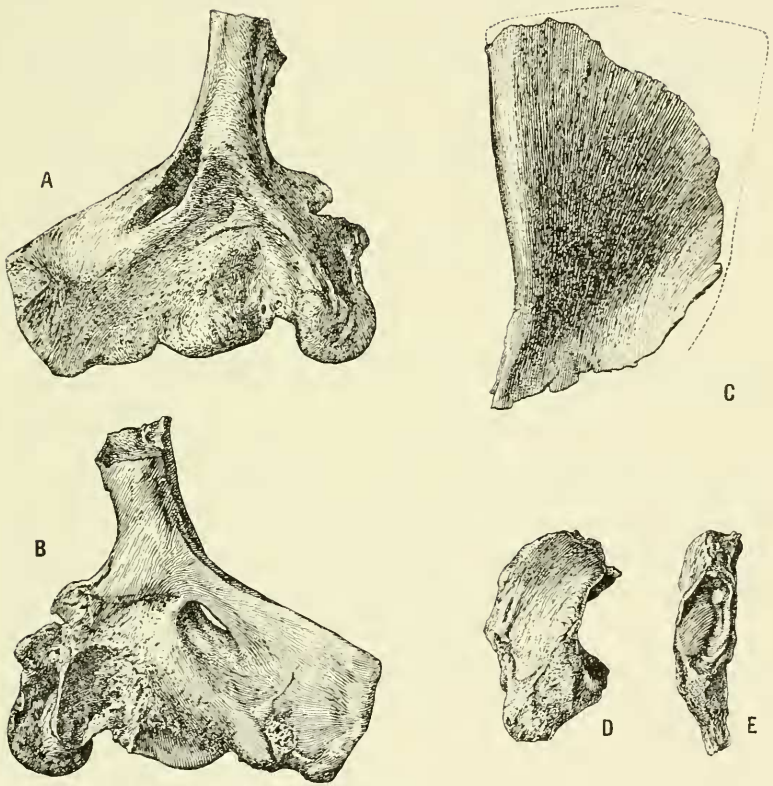

Figure 1. *Clepsydrops magnus* sp. nov. *A, B,* distal end of right humerus, dorsal and ventral surface. *C,* upper part of right scapular blade; probable outline when complete suggested by broken line. *D, E,* lateral and proximal views of upper end of left ulna. All x ½.